

21 January 1971

Materiel Test Procedure 7-3-095
U. S. Army Aviation Test Board

U. S. ARMY TEST AND EVALUATION COMMAND
COMMODITY SERVICE TEST PROCEDURE

SURVIVAL EQUIPMENT (AVIATION)

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1. OBJECTIVE

This document identifies existing test methods and techniques necessary to determine the degree to which aviation survival equipment meets the requirements of the Qualitative Materiel Requirement (QMR), Small Development Requirement (SDR), or Technical Characteristics (TC's), and whether or not this equipment is suitable for Army use.

2. BACKGROUND

a. Survival equipment is intended to provide the downed aircrew member and passenger with the necessary essentials for sustaining life, signaling for assistance, and for avoiding contact with the enemy in hostile areas. Uses of survival equipment may be for obtaining bearings, for protection against disease and environmental conditions, for obtaining and preparing food and water, for personal comfort, and for repairing equipment.

b. Survival equipment is required to retain design characteristics during specified storage in the aircraft environment and to be satisfactory for use following shock situations involved when these items are carried or worn by parachuting individuals or following crash landings.

c. Survival equipment may be packaged in kit form to be worn or attached to the individual crewmember or passenger during flight. Certain survival equipment in kit form can be worn as a vest, while others are designed to be strapped to either leg. Other survival kits and equipment are not worn, but are attached to the individual or his personal equipment in some manner to minimize the possibility of loss during emergency conditions.

d. The survival equipment service test must provide realistic situations and opportunities for evaluating a variety of survival items' suitability for aviation crewmember use from the standpoints of operational suitability, durability, maintainability, human factors, and safety.

3. REQUIRED SUPPORT

- a. Measuring tools to determine dimensions, weights, and time.
- b. Test subjects with appropriate MOS.
- c. Photographic equipment.
- d. Survival training facilities, e.g., wilderness areas exhibiting appropriate climatic characteristics.
- e. Aircraft, various.
- f. Data reduction (forms, questionnaires) personnel.
- g. Inspection (pretest and post-test) personnel.

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- h. Standard survival equipment and/or kit(s).
- i. Survival equipment maintenance facilities and test equipment.
- j. Support as required from outside agencies.

4.

REFERENCES

- A. USATECOM Regulation 70-23, Research and Development: Equipment Performance Reports (EPRs).
- B. USATECOM Regulation 70-24, Research and Development: Documenting Test Plans and Reports. (As implemented by USAAVNTBD Pamphlet 705-1).
- C. USATECOM Regulation 385-6, Safety: Verification of Safety of Materiel During Testing. (As implemented by USAAVNTBD Memo 385-10).
- D. USATECOM Regulation 700-1, Quality Assurance: Value Engineering.
- E. USATECOM Regulation 108-1, Photographic Coverage. (As implemented by USAAVNTBD Memo 108-1).
- F. USATECOM Regulation 750-15, Maintenance of Supplies and Equipment: Maintenance Evaluation During Testing. (As implemented by USAAVNTBD Memo 750-2).
- G. MTP 7-3-500, Physical Characteristics.
- H. MTP 7-3-501, Personnel Training.
- I. MTP 7-3-506, Safety.
- J. MTP 7-3-507, Maintenance.
- K. MTP 7-3-510, Human Factors.
- L. MTP 7-3-519, Photographic Coverage.
- M. TM 55-8465-206-13, Organizational and DS Maintenance Manual for Survival Kits: Army Aircraft.
- N. MIL-STD-129, Marking for Shipment and Storage.

5.

SCOPE

5.1 SUMMARY

a. The evaluation of functional suitability is one service test requirement. Additional tests must address durability, maintainability, safety aspects associated with use, compatibility with personal equipment and appropriate aircraft, and suitability of the equipment from the human factors standpoint.

b. To evaluate these elements, service tests are conducted under operational conditions by personnel representative of those who will use the equipment in actual aviation operations and with current Army aircraft. The service test will record the observations of supervisory test personnel together with those of appropriate specialists called upon to comment on the equipment. Test personnel will be interviewed and their observations and recommendations will be recorded by questionnaire and correlated with other similar information and with the still and motion pictures taken during testing.

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c. The data collected during the service test will be reviewed to obtain subjective and numerical indicators which characterize the equipment's suitability. Tabulations, charts, and other graphic displays will be employed to present these indicators. Evaluation of the data will include comparisons with performance criteria and with the performance indicators obtained from the use of standard survival equipment and kits employed in similar or identical mission roles.

5.1.1 Preparation for Test

This section provides guidance for test project planning, facility and equipment requirements, and preparation for test personnel training and familiarization.

5.1.2 Test Conduct

The following subtests should be conducted:

a. Arrival Inspection and Physical Characteristics.

b. Operational Suitability - This section provides procedures for evaluation of the areas listed below:

- 1) Compatibility with Army aircraft and crewmember personal equipment.
- 2) Functional suitability.
- 3) Durability.

c. Maintenance - An evaluation of the equipment's maintenance characteristics before and during use under survival conditions.

d. Human Factors - An assessment of the user's physical and psychological reactions to the equipment as an attached or worn kit and to individual survival items under simulated emergency conditions.

e. Safety - An evaluation to identify any hazardous conditions when the equipment is worn by crew members or during its use in a survival environment.

5.1.3 Test Data

This section details the test data to be collected and recorded while completing the procedures of 6.2, Test Conduct.

5.1.4 Data Reduction and Presentation

This section provides instructions for evaluating and displaying the data recorded and collected during testing.

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5.2 LIMITATIONS

This MTP is intended to be used as a basic guide when preparing test plans for survival equipment. Suitability for Army use criteria and attendant test procedures shall be determined in response to specific QMR, SDR, or TC requirements.

6. PROCEDURES

6.1 PREPARATION FOR TEST

The project officer should follow reference 4.B., with respect to plans and reports of tests. Certain planning information specifically applicable to survival equipment is provided by the following paragraphs.

6.1.1 Test Planning

6.1.1.1 Test Criteria

The project officer shall select test criteria which will adequately satisfy the stated objectives. Efforts should include, as a minimum, the following actions:

- a. Review the test directive.
- b. Study the QMR, SDR, or TC's.
- c. Review authorized sources of criteria such as-
 - 1) Designated test directive references.
 - 2) Survival equipment specifications, or drafts thereof.
 - 3) Special instructions accompanying the test directive.
- d. Review inputs from coordinating agencies.
- e. Study survival equipment engineering test data, recommendations, and conclusions, as applicable.
- f. Regional survival technical manuals.

6.1.2 Required Equipment, Facilities and Personnel

Arrange for the items listed under Section 3, REQUIRED SUPPORT, and for special consultants, e.g., aeromedical specialists, etc., or other personnel required to assist in the evaluation of food and medical items. Schedule photographic coverage required; see reference 4.E.

6.1.1.3 Prepare Questionnaires for User Personnel

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6.1.2 Familiarization

Consult appropriate sections of reference 4.H, and familiarize test personnel with the survival equipment and procedure of the service test. Accomplish, as a minimum, the following actions:

- a. Familiarize personnel with the survival equipment under test and the characteristics of appropriate land-water survival areas and conditions.
- b. Familiarize personnel with specific evaluation objectives.
- c. Acquaint flight personnel and other applicable test subjects with questionnaires, forms, etc., which are required during the operational evaluation of the survival equipment.
- d. Demonstrate recommended and alternate techniques for using each item of survival equipment.
- e. Familiarize personnel with restrictions to be observed when wearing (or carrying) the survival equipment in the aircraft.
- f. Brief personnel on survival techniques only to the extent that operational crewmen are instructed.
- g. Familiarize appropriate personnel with references 4.E. and 4.L. applicable to the photographic coverage required.

6.2 TEST CONDUCT

6.2.1 Arrival Inspection

- a. Inspect shipping containers for evidence of damage. Photograph damage as appropriate.
- b. Examine container markings for compliance with appropriate requirements of reference 4.N. or other governing documents. Record container markings which identify contents and indicate quantity. Photograph any special markings which caution handlers or denote special handling.
- c. Unpack the equipment using the instructions furnished. Inventory the contents against the Basic Issue Item List (BIIL) if furnished, or the external markings of the container identifying contents. Submit Equipment Performance Reports (EPRs) where discrepancies are noted.
- d. Determine condition of equipment for test as demonstrated by freedom of the equipment from damage or defect. Equipment damage and/or material defects shall be photographed and reported by EPR.

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6.2.2 Physical Characteristics

Conduct measurements, weighings and observations as required to determine the physical characteristics of the survival equipment kit and individual survival equipment items. Consult reference 4.G. Photograph the survival kit, major components, and individual items as required to adequately illustrate specific features. Included will be a detailed description of material included in the kit.

6.2.3 Operational Suitability

6.2.3.1 Compatibility with Army Aircraft and Crewmember Personnel Equipment

a. Issue the survival equipment or kits to personnel scheduled for regular flight duties. Brief personnel on test procedures and distribute questionnaires. Evaluate the survival equipment for compatibility with all inventory aircraft to include aircraft seats and ejection systems, compartment doors, passageways, controls, and crewmember stations, etc. Record any evidence of the equipment catching, snagging, or interfering with aircraft controls or with the entrance to or exit from the aircraft. Observe crewmembers performing routine and simulated emergency actions at normal and alternate duty stations. Evaluate, as a minimum, the following:

- 1) Ease of performing routine and emergency tasks and degree of freedom from interference with and without the survival equipment being attached to or worn by the crewmember.
- 2) Evidence of any restrictions in the movement of the limbs.

b. Don or attach the survival equipment and/or kit and evaluate compatibility with various items or personal equipment. Include, as a minimum, the items listed below:

- 1) Weapons worn by the crewmember.
- 2) Parachutes, including actual paradrop.
- 3) Personnel armor.
- 4) Protective items, e.g., helmet, oxygen mask and accessories, and/or protective masks.
- 5) Flotation equipment.
- 6) Crew harness.

c. Evaluate doffing characteristics of worn survival equipment or kits under the stress of simulated ground emergency conditions.

d. Evaluate characteristics of the equipment which could cause or hasten the capture of an evading crewmember in hostile areas.

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6.2.3.2 Functional Suitability

a. Inspect the survival equipment and kit contents for appropriateness and quantitative adequacy of individual items.

b. Issue the equipment or kits to aircrew members scheduled to undergo survival training in outdoor terrain areas. The following considerations should, as a minimum, be observed:

- 1) Issue to at least half the group undergoing survival training standard inventory Army survival gear and kits to provide control data for comparison purposes.
- 2) Expose the survival equipment/kits used in this evaluation to the aircraft and expected altitude environment for fifty to seventy-five flight hours, or as otherwise specified.
- 3) Conduct tests in climatic conditions representative of the regional area intended for the survival equipment.

c. Evaluate the survival equipment with the exception of the effectiveness of medical items, under the conditions specified by b. above. As a minimum, conduct the following evaluations, if applicable:

- 1) Effectiveness of emergency signaling devices, such as mirrors, pyrotechnic devices, lights, radios, etc., through the entire spectrum of illumination conditions.
- 2) Suitability of fire kindling devices or materials.
- 3) Adequacy of personal equipment, e.g., sunglasses, soap, etc.
- 4) Effectiveness of insect repellant and nets, head protectors, etc.
- 5) Suitability of tools and implements, e.g., knives, saw, etc.
- 6) Adequacy of fishing equipment.
- 7) Effectiveness of animal snares and traps.
- 8) Accuracy and usefulness of survival literature and instructions.
- 9) Dietary adequacy of subsistence items. Representatives of USAARL should be present or perform this evaluation, as applicable.
- 10) Parraft kits in appropriate water test areas which are suitable for determining, as a minimum, the following data:
 - a) Boarding ease.
 - b) Ease of righting capsized craft under various wind conditions, e.g., cross wind, down wind, etc.
 - c) Handling suitability.
 - d) Ability to protect user against wind, rain, spray, etc.
 - e) Suitability of accessories, e.g., sea anchor, paddles, etc., and adequacy of packaging of subsistence items for avoiding contamination following initial usage.

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- 11) The effect of water, heat, or cold on functional suitability.

d. Evaluate comparative availability of components (i.e., location, ease of entry if in a kit, etc.) and stowage capability for reuse if applicable.

e. The ease of opening and repacking the kit container under normal conditions and when physical capability is impaired.

6.2.3.3 Durability

Evaluate the capability of the survival equipment to withstand prolonged use under the harsh conditions of typical survival environments. Perform the following:

a. Issue the equipment/kit under identical arrangements as specified by 6.2.3.2 paragraph b.

b. Inspect each item of survival equipment (including carrying cases, etc.) at the completion of the functional evaluation. Question personnel according to a prepared questionnaire to determine the following:

- 1) Ability of tools and implements to function after exposure to use in climatic and geographic conditions.
- 2) Suitability of fabrics, plastic sheetings, bags, clothing, etc., in withstanding use as demonstrated by freedom from leaks, tears, worn out places, rot, etc.
- 3) Preservation characteristics of food and medical items under regional conditions.
- 4) Duration characteristics of batteries.
- 5) Suitability of expendable items in regard to quantity provided.

c. Record the number of uses of each item and whether it performed its intended function.

d. Record duration of exposure to each environment.

e. Record duration of actual use in its intended function.

6.2.4 Maintenance

a. Determine the suitability of the survival equipment's maintenance characteristics and maintenance test package. Consult references 4.F., 4.J., and 4.M and prepare a program which emphasizes the following:

- 1) Maintainability.
- 2) Reliability.

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- 3) Tools and test equipment.
- 4) Technical manuscripts and manuals.

b. Include in the maintenance subtest the preparation of the following charts:

- 1) Maintenance and Reliability Analysis Chart.
- 2) Parts Analysis Chart.
- 3) Special Tool Analysis Chart.
- 4) Maintenance Package Literature Chart.

6.2.4.1 Maintainability

a. List and provide complete details of occurrences for scheduled maintenance without downtime and unscheduled maintenance with minimum downtime (minor adjustments).

b. List and provide complete details of occurrences for unscheduled maintenance involving excessive downtime and/or provide replacement or repair of components.

6.2.4.2 Reliability

Reliability will be determined during the service test by performing the following by component:

- a. Maintain an accurate log of the accumulated hours of use.
- b. For each maintenance action, record the following:

- 1) Conditions which indicated the problem.
- 2) Component or feature involved and method used to determine cause.
- 3) Damage caused to associated components due to the failure.
- 4) Repair procedures followed, personnel, material, and tools required.
- 5) Elapsed time since last malfunction.

c. From the times recorded, calculate the mean time between failure (MTBF), the mean time to repair (MTTR), and the availability (A).

6.2.4.3 Tools and Test Equipment

Determine, through utilization, whether or not common and special tools and test equipment are suitable for the intended purpose and maintenance level and if the special tools provided (or specified) are excessive.

6.2.4.4 Technical Manuscripts and Manuals (Maintenance Portions)

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Perform the following:

- a. Review the maintenance literature and instructions for accuracy and completeness.
- b. Note the presence of lists of recommended repair parts, tools, test equipment, and procedures for alignment, calibration, and troubleshooting.

6.2.5 Human Factors

Conduct human factors evaluations simultaneously with all service test evaluation. Consult reference 4.K. Determine the compatibility of equipment while being transported or used.

6.2.5.1 Aircraft Environment

Evaluate the crewmember's physical and psychological reaction to the survival equipment and/or kit package if it is (they are) worn or carried, etc., in the aircraft environment. Consider, as a minimum, the following:

- a. Comfort.
- b. Ease of application.
- c. Restriction of movement due to bulk or attaching straps, etc.
- d. Weight characteristics and/or placement to effect crewmember's balance.

6.2.5.2 Survival Environment

Evaluate the crewmember's physical and psychological reaction to individual survival items in the regional or transitional climatic areas used for operational testing. Consider, if applicable, the following:

- a. Protection from the weather, including shelters, clothing, personal equipment such as sunglasses, etc.
- b. Comfort, including freedom from insects, skin irritations, sunburn, etc.
- c. Freedom from hunger, including adequacy and palatability of food items.

6.2.6 Safety

Evaluate the survival equipment or kit if worn by the crewmember and when the equipment and individual kit items are utilized in the survival environment to determine the existence of any hazard or condition that would endanger personnel.

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6.2.6.1 Aircraft Environment

Observe the survival equipment as worn or carried by personnel in all Army aircraft and identify those characteristics which were hazardous or were indirectly the cause of any hazard. Examples of such hazardous characteristics include the tendency of the kit to interfere with the operation of flight controls or special emergency equipment such as an ejection seat and undesirable effects of altitude on kit components. Where possible, photograph any hazardous conditions or recreations of hazardous instances.

6.2.6.2 Survival Environment

Observe the survival equipment and kit components in use. Record and photograph any occurrences which endangered the safety or health of personnel.

6.3 TEST DATA

6.3.1 Arrival Inspection

Record:

a. Markings which appear on shipping container(s) and degree of compliance with reference 4.N., or other governing documents.

b. The results of inventories conducted against the BIIL, container markings, maintenance test package inventory list, and/or packing lists. Note number of EPR's submitted.

c. Status of received equipment with respect to suitability for service test, e.g., freedom from serious defects.

6.3.2 Physical Characteristics

Record the data required by reference 4.G.

6.3.3 Operational Suitability

6.3.3.1 Compatibility with Army Aircraft and Crewmember Personnel Equipment

Record:

a. Observed ease with which personnel performed routine and emergency tasks without survival equipment being worn or attached.

b. Observed ease with which personnel performed routine and emergency tasks while wearing the equipment or kit.

c. Any observed restriction to the movement of the crewmember's limbs and use of controls.

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d. Ease with which survival equipment was put on, and evidence of any interference with various items of personal equipment.

e. Degree of compatibility with the following personal equipments:

- 1) Weapons.
- 2) Parachute.
- 3) Personnel armor.
- 4) Helmets, masks, etc.
- 5) Flotation equipment.
- 6) Crew harness.

f. Removal characteristics suitability under routine and emergency conditions.

g. Characteristics of the equipment or kit items which could hasten the capture or cause injury at the hands of the enemy.

6.3.3.2 Functional Suitability

Record, if applicable:

a. Appropriateness and quantitative adequacy of kit contents as a result of inspection by qualified personnel.

b. Description of survival conditions simulated for the purpose of evaluating the kit or equipment. Include record of temperatures and weather conditions encountered on a daily basis. Identify the control equipment and personnel possessing each type of equipment.

c. Length of time at the maximum altitude encountered by each kit or equipment prior to the field evaluation.

d. Restrictions to movement through various types of terrain.

e. Effectiveness of emergency signaling devices. Include length of battery and smoke signal life.

f. Adequacy of personal equipment provided by the kit(s).

g. Effectiveness of insect repellant, nets, head protectors, gloves, etc.

h. Suitability of tools and implements, e.g., note any tendency to become dull with use or to break, etc.

i. Adequacy of fishing equipment.

j. Effectiveness of animal snares and traps.

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k. Instances of survival literature being incorrect or incomplete for conditions encountered.

l. USAARL analysis results (food items).

m. Paracraft suitability, such as--

- 1) Boarding ease.
- 2) Ease of righting capsized craft under various wind conditions.
- 3) Handling suitability.
- 4) Personnel protection ability.
- 5) Adequacy and effectiveness of accessories.

6.3.3.3 Durability

Record:

a. Conditions under which survival equipment or kit was evaluated for durability, e.g., climatic parameters, area, duration, identification of personnel, etc., and condition of the equipment/kit at the beginning of the evaluation.

b. Results of inspection and interview(s) with personnel using the equipment/kit(s), e.g.,--

- 1) Ability of tools to be used with increasing wear, etc.
- 2) Suitability of fabrics, plastic materials, etc., to withstand usage, exposure to harsh climatic conditions, etc.
- 3) Preservation characteristics and suitability of food items.
- 4) Suitability of battery durability characteristics.
- 5) Suitability of expendable items from the quantity standpoint.
- 6) Number of times each item was used.
- 7) Adequacy of function.
- 8) Duration of exposure to environment.
- 9) Duration of physical use.

6.3.4 Maintenance

Record:

a. Maintainability

- 1) Maintenance operations performed.
- 2) Personnel required, time, tools, etc.
- 3) Elapsed time since last maintenance requirement.

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b. Reliability

- 1) Total operating time of the equipment.
- 2) Time since last failure.
- 3) Time required to repair.
- 4) MTBF.
- 5) MTTR.

c. Tools and Test Equipment (Special tools required)

- 1) Tools or test equipment required but not provided.
- 2) Excess tools provided.
- 3) Recommendations for changes to tools or test equipment allowances for system.

d. Technical Manuscripts and Manuals

- 1) Procedures found to be inaccurate or incomplete.
- 2) Missing lists or procedures for specific maintenance tasks.

6.3.5

Human Factors

Record:

a. Aircraft environment

- 1) Degree of comfort attainable wearing the equipment or kit. Specific areas or instances where the equipment or kit was not considered suitable.
- 2) Ease of installation and removal. Elaborate on any exceptions to criteria.
- 3) Painful or inconvenient restriction to movement of limbs and manipulation of essential and emergency controls.
- 4) Suitability of weight characteristics when considered with other personal equipment required for a particular task or mission.

b. Survival environment

- 1) Suitability of each item/component to perform its intended survival use.
- 2) Suitability of arrangement of components for use, ease of access to and replacement of components if applicable.
- 3) Adequacy of quantities of consumable components and of the packaging of these components.
- 4) Observed instances of interface problems occurring between the use of the survival equipment or specific kit item.

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6.3.6 Safety

Record:

a. Aircraft environment - Equipment or kit characteristics which presented a hazard(s) to personnel. Describe fully.

b. Survival environment - Equipment or kit item characteristics which were themselves hazardous or were used in a manner which led to a hazard.

6.4. DATA REDUCTION AND PRESENTATION

a. Summarize all data using tabulations and/or charts, as appropriate.

b. Identify all photographs and where possible, correlate with appropriate narrative descriptions.

c. Analyze the data to determine the degree of compliance with the specific requirements of the QMR, SDR, or TC's.

d. Conclude the presentation with a summarization of the survival equipment or kit's suitability for Army use.

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